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WE have received a copy of the Building-Act prepared for the City of Providence by the Rhode Island Chapter of the American Institute of Architects, at the request of the City Council. It fills a pamphlet of sixty octavo pages, and has evidently been prepared with unusual care. We are impressed in reading it over, with the thoroughness with which all the essentials of building have been considered, so far as they are subjects for municipal control, — so much thoroughness, in fact, that a copy of this proposed act would be no bad manual of building for an architectural student. The main points covered by the law are of course such as are covered by most of the building-acts of American cities; and there is no need to attempt a synopsis of them. But in many points the precautions of the act reach further than is common with us; and though it is not brought to the standard that would be thought necessary in a Continental European city, it makes a considerable advance on our ordinary methods of building, and, we suspect, is on the whole a little before any that are in force in the country.

THERE is a large manufacturing population in Providence; and for this reason, we suppose, special attention has been given in the act to the control and construction of tenement-houses. They are required to be of brick or stone; and much care is taken to compel a reasonable amount of light and ventilation for them. Where they abut on streets not more than twenty feet wide — we hope there are not many such in Providence — they are not to exceed thirty feet in height; and where they stand on the same lot with other buildings, in front or rear, there must be a space of not less than ten feet between the buildings, or more in proportion to the height, if they are of more than one story. They are required to have at least one chimney for every tenement or set of rooms; their stories must never be less than eight feet high; half at least of every attic room must be of this height — it must have at least one outside window, and a ventilator over the door; the top of the window must be at least seven feet above the floor, and must open. Every room of less than one hundred feet area, if it has not an outer window or an open fireplace, is required to have a special ventilating shaft to the roof, or other equivalent provision. It is forbidden to let or occupy for a lodging any underground room which has not been so let before the passage of the act; nor any such room whatsoever, unless it is at least seven feet high and one foot above ground, and unless it has an area of two feet wide in front of it, extending down to below the floor level. The owner or lessee is required to whitewash the walls and ceilings twice a year. The act prescribes the rule recommended by the Superintendent of Buildings of Chicago, that plans of all theatres, halls, churches, schools, and other places of public assembly, showing their seating capacity, means of ingress and egress, and of extinguishing fires, shall be kept on file in the department of buildings, and shall be always accessible to the public. We notice among the provisions which here and there show the care with which the subject has been considered, that no building is to be allowed to be used for any wood-working factory or shop unless it has a fire-proof vault, or bin, into which the shavings, sawdust, and other inflammable refuse shall be swept every night; that all stud partitions, and spaces behind furring, are ordered to be filled with brick, concrete, or plaster, for the whole thickness of each floor, and six inches higher; that the weight to be provided for in flooring different classes of buildings is fixed by the law, and no floor is to be allowed to carry more than its appointed load, unless on certificate of its strength from a competent architect or engineer; and that the architect who builds a storehouse or warehouse is required to give a certificate of the weight with which its floors may safely be loaded. The act, it is true, exists as yet only on paper. It is to be hoped that it will not be altered out of its efficiency in going through the legislature.

THE State Commissioners on the new Capitol at Hartford, Conn., which is now building from Mr. Upjohn's designs, have submitted to the governor of the State their report for the past year, from which it appears that the whole amount thus far expended on the building has been about one million four hundred and twenty-five thousand dollars. The marble-work of the exterior is nearly finished, and the greater part of the roof on. The main tower has been brought up to the roof level, and the cupola will be begun in the spring. Nearly all the brick floors are in, the columns and girders for the gallery of the representatives' hall are in place, the finishing of the senate chamber is begun, and several of the rooms are ready for plastering. The steam, water, and gas pipes are in; the boilers (four of fifty horse-power each) for heating the building have been set in a vault outside, and are working satisfactorily. The committee report that thus far the work has been kept within the estimates. They wisely deprecate an effort to finish the interior of the building hastily, and do not commit themselves to having it ready for use at the end of the present year. The crowning figure for the dome has been contracted for with Mr. Randolph Rogers of Rome. The statue is to be of bronze, and will be cast, like most of our bronze statues, in the royal foundry at Munich. Mr. C. B. Ives, a Connecticut sculptor now in Rome, has received a contract for the statues of Sherman and Trumbull, of heroic size, which are to stand over the east entrance. Negotiations are in progress for the twelve statues which will crown the pinnacles at the springing of the dome. The fall in prices of building has enabled the commissioners to cover the cost of this statuary with the appropriations already made for the work; and they are confident that except for some of the sculpture, which it was expected would be supplied from time to time after the building was done, the cost of the whole building can be kept within their former estimate of two millions and a half.

THE new Trinity Church in Boston (Messrs. Gambrill and Richardson, architects), consecrated last week, is perhaps the most noteworthy American church of the day, unless it be the new Catholic Cathedral which is building in New York. Our readers are already familiar with its general aspect from the heliotype we published of it two numbers back; we hope in the course of time to give fuller illustrations of it. The front towers, it may be said, are not what the architects would have them, and hope some day to have them. The notable things in the treatment of the church are the novelty of the style, for this country, and indeed for any country in this age; the grand mass of the central tower, and the way in which the plan is adapted to the needs of a large congregation. In this last matter the disposition of the floor, entirely unencumbered by pillars, gathering the whole congregation within near reach of the officiating clergyman's voice; the unusual size of the chancel, which is sixty feet deep and fifty wide, the communion-table being encircled by the rail, to allow a large number to receive the communion at once; the broad galleries filling the transepts, — all these deserve special notice. The interior architectural treatment, too, is new here; the flat ceiling of the central tower is a hundred feet above the floor; the trefoiled wagon-arched ceiling has no fellow in the country. The church has very visible

faults. The shortness of the nave is a mistake that must now be evident to the architects. It mars the proportion of the interior, and huddles the exterior together. The church greatly needs two more bays, which might have been added in the building at a trifling cost, and for which the ground gave room enough. The detail is various in style and quality, and seems to us to oscillate between conventionalism and naturalism: on the exterior much of it looks carelessly studied, and even rude, while much is rich and refined. The curtain walls of the central tower seem almost too much cut away into openings; which is due, we presume, to a desire to lessen the weight of the tower as much as possible. Covering the broad louvre-boards of the upper tower windows with the same tiles as the roof above gives the impression that the roof extends down inside to the bottom of these windows, which look like openings in a parapet. This, however, is a difficulty easily removed. For all these drawbacks, however, there is in the work a union of richness and breadth, a singular charm of color, and a noble dignity, that lift it above any thing that has been done in the country within our knowledge. We mean at another time to speak of the decoration of the church, which has been done in an extremely interesting manner under Mr. La Farge.

WE are glad to learn that the duty of providing for the proper reception and placing of the Bartholdi statue of Liberty has been taken in hand by persons of influence enough to assure its being properly performed. The committee, which was appointed by a meeting of New York gentlemen at the Century Club last month, and which includes among others, Mr. Bryant and Mr. Evarts, has issued an address to the people of the United States, inviting a general subscription in amounts of from ten cents to one hundred dollars, and asking the aid of chambers of commerce, boards of trade, clubs and societies, public or private, in furtherance of it. A sub-committee has already been formed in Boston, and a circular issued with request for subscriptions. A memorial addressed to the Government asking permission to occupy Bedloe Island with the statue has been referred to Congress by the President with his approval. The details of the project are well known: we have more than once noticed it (*American Architect*, Vol. I. pp. 137, 184, 329). Two hundred copies of the first model are to be made in terra-cotta, and sold at three hundred dollars each for the benefit of the undertaking, after which the model will be destroyed.

WE hope that there will be no longer any difficulty in raising with promptness the money which is needed for providing the pedestal and setting up the statue. It was a generous enterprise, as it certainly was a novel one, for the friends of the United States in France to provide so costly a birthday gift for our nation. It is the custom of the time to set little value on professions of international regard; but whatever justification this may have in diplomacy, it is sure that there is very real warmth in the good feeling of individuals that urges them to an undertaking of such difficulty and cost. The character and influence of the men who lead it (Laboulaye, Henri Martin, Lafayette, Rochambeau, Tocqueville, Rémusat, and others of note) make it a kindness which it is worth our while to acknowledge thankfully and gracefully, and to do our best to preserve, — to say nothing of the duty of courtesy, which seems as much in place between nations as individuals, notwithstanding our recent precedents to the contrary. There is not the smallest doubt that when once we receive the gift, we shall prize it highly. It will be becoming to acknowledge this in advance, and not to dull the good feeling of the friends who are preparing it for us. The artistic success of the scheme is a matter of experiment, like any novelty; but the ability of the sculptor who has undertaken it, the dignity of the conception, and the grand isolation of the chosen position, are a good guaranty of success. The committee, with an eye to the predilections of their countrymen, shrewdly remind them that the statue is to be one hundred feet high; to which it may be added that it will be twice as high as the famous sitting statue of Buddha in Japan, and nearly twice as high as the Bavaria at Munich. We do not remember the dimensions of the statue of Arminius in the Thuringian Forest, unveiled about a year ago.

IT is said that the Board of Engineers appointed by the Government to examine the condition of the Washington Monument have reported that it will not do to try to finish it. They have tested the soil on which it is built, and find it not solid enough to bear the weight of the intended structure. They are expected to recommend that the monument be taken down, and its material used in a new one to be built in the circle at the intersection of Massachusetts Avenue and Fourteenth Street, — a large and rather high open space in the northern part of the city, which would display a commanding structure to great advantage. We are very glad to believe that this report will settle the question of carrying out the present design, and are thankful for any cause that will prevent what promised to be an irredeemable blunder.

A TASK in engineering which has been before the world since the day of Julius Cæsar was completed not long ago in Italy. About fifty miles east of Rome, among the mountains of Abruzzi, and two thousand feet above the sea-level, lies, or lay, the Lake Fucino, famous for the efforts made to drain it by the Roman emperors and others of later times. The lake had no outlet, was broad and shallow, being thirty miles or more in circumference, and so was subject to excessive overflow, submerging its borders for miles about it, and making the cultivation and even the inhabiting of the surrounding plain very precarious. It was one of Cæsar's projects to drain it; but the thing was not seriously attempted till the reign of Claudius. He undertook, not to drain the lake, but to reduce it, and control its overflows, by tunnelling an outlet through the surrounding hills. He kept thirty thousand men at work for eleven years, it is said, till he had made a tunnel three miles and a half long, leading the water to the neighboring river Liris. The immense scale of the work made Pliny applaud it as the eighth wonder of the world; and when it was done the emperor celebrated it with a bloody *naumachia* or sea-fight of gladiators, which is as famous in history as the work it commemorates. Nevertheless by the time of Tacitus the tunnel had fallen into ruin, owing, as the historian says, to the bad construction of the contractor or superintendent, who grew rich by the work; and in spite of attempts by Trajan and Hadrian to restore it, gradually became choked, and was given up. The Emperor Frederick II. tried to re-open it in the thirteenth century, but failed.

PRINCE TORLONIA, to whom the final accomplishment of the great work within a year or so is due, has just published an account of it in a book. It is more than twenty-two years since he began it. The lake had risen some thirty feet since the latter half of the eighteenth century; and in 1852 a private corporation gained from the Bourbon Government a grant of the land in the bed of the lake, on condition that they succeeded in draining it. In 1854 Prince Torlonia purchased the rights of the company, and undertook the whole enterprise himself. He put it in charge of a noted Swiss engineer, M. de Montricher, who had constructed the water-works of the city of Marseilles. Montricher died half a dozen years after, and his next successor, M. Bermont, died in 1870, leaving the work to be finished under a third engineer, M. Brisse. The difficulties of the work, and the determination of the prince, made it a saying among the country people that "either Torlonia would drain Fucino, or Fucino would drain Torlonia;" but he has survived to see it finished, and to begin to reap his reward in the cultivation of the reclaimed lands. The tunnel has followed mainly the line of Claudius, but is deeper and of greater capacity than his. The Claudian excavations were found to be very irregular in section and construction, branching into numberless small galleries like rabbit-burrows, and reached by nearly forty square shafts lined, some with timbers, and some with the Roman masonry known as *opus reticulatum;* some of the shafts being three hundred feet deep, and the greater part of the whole work excavated in the solid rock. The length of the new tunnel is said to be 6,887 yards, and the fall from the lake to the river about 80 feet.

COVERS are now ready for our first volume. The publishers will bind old numbers for two dollars the volume, or will send, post-paid, a cover for binding for one dollar.

THE PROPOSED ACT FOR THE SECURITY OF THEATRES IN NEW YORK.

DIRECTLY after the destruction of the Brooklyn Theatre, the New York Chapter of the American Institute of Architects, through its Examination Committee, took up the problem of preparing such amendments of the building-laws for the city as should enforce the substantial building of theatres, and insure as far as proper arrangement and sound construction could, aided by the right appliances for controlling fires, the safety of audiences. The Committee, after spending much time and labor on the subject, have prepared an act "to provide for stability of construction and security against conflagration, panic, or other accident in theatres hereafter to be erected in the city of New York," which, after being approved by the New York Chapter of the Institute and by the Board of Underwriters, was introduced some days ago into the State Senate by Mr. Gerard. We have received a copy of the bill, which has been thoroughly studied and carried out in its technical detail with admirable care. It embodies the main provisions which European experience has shown to be important, and which are enforced in the French and German laws for theatre-construction, with such special precautions as have been suggested by study of our experience at home, and notably by the Brooklyn disaster. As it stands, it contains substantially all the requirements that are agreed upon as most essential; though there are one or two points on which we should have been disposed to urge further precaution, and one or two matters of detail which we should not have pressed so far.

In regard to the situation of theatres, the act proposes a much-needed reform. This is a point that in well-administered foreign cities is carefully guarded, but in which in the United States the most necessary precaution is neglected. We sincerely trust that nothing will be done to modify here the stringency of the provisions of the act. Not only are theatres buildings in which extraordinary facilities for egress at various points are required for the safety of those who attend them, but they are dangerous neighbors; and since those whose buildings adjoin them cannot protect themselves against risk from them, it is reasonable that the law should do so as far as practicable. The act provides that every theatre, or building used as such, shall have at least one front on a public street, in which there shall be suitable means of entrance and exit for the audience. It orders that an open area shall be reserved on all sides of that part of the building which contains the auditorium and the stage. The area is not to be less than ten feet wide, — for theatres which hold more than one thousand people a greater width may be required by the superintendent of buildings, — it must have one or more outlets upon the street, and the outlets must not aggregate less than twenty feet in width. They are to be closed with gates swinging outward, kept open during the performances, and far enough recessed not to swing into the street. If any buildings are built over these outlets, they are to be of fire-proof construction throughout. This is of course intended to cover the case of the front of the building being used for shops or other not theatrical premises; and the act further orders that no portion of it shall be used for a hotel or lodging-house or factory workshop or storehouse. It also forbids — and this is in our minds a point of great importance — the use of the space above or beneath the auditorium for storage or for workshops. Scenery and decorations not actually in use are not to be kept in the theatre itself, but in a separate building; nor are the carpenters' shops and scene-painting rooms to be in the theatre; and finally, no lodgings are to be allowed in theatres, except for the janitors and ticket-sellers.

In regard to construction, the act provides that all exterior walls shall be of stone or brick; and that when the fronts are of iron, these shall be solidly backed with brick. A fire-wall of stone or brick must separate the stage from the auditorium, and must be carried up into a parapet coped with stone or terra-cotta, four feet above the roof. The interior walls also which separate the auditorium from the rest of the theatre, and those which enclose rooms, staircases, or corridors for the use of the audience, or the dressing-rooms for the actors, are to be of fire-proof material, as are all the staircases, and the floors of that part of the building which the audience uses. The roof must be incombustible and framed in iron; the ceiling of the auditorium, and all decorations and fixtures above or on the sides of the proscenium arch, must also be fire-proof. It is ordered that there shall be doorways in the proscenium wall, on both sides of the curtain-opening at every floor. These doorways must be accessible at all times from both the stage and auditorium, and must be provided with double wrought-iron doors. All the doors of the auditorium and of the dressing-rooms, or in any of the walls that are required to be fire-proof, must also be of wrought iron. We are not sure, by the way, that it is desirable to insist on so many iron doors. They are apt to be in the way, and more or less unmanageable. In places where they were much used, there would be little likelihood of their ever being shut, and a very good chance of their being forgotten or refusing to shut in an emergency. A later paragraph in the act, however, allows the substitution of double-battened doors of wood in two thicknesses, crossed diagonally; and these would probably be sufficient in most positions. For the openings in the proscenium wall, the iron doors would be absolutely necessary, but we are inclined to doubt the wisdom of providing these openings. They are intended, obviously, to furnish a way of escape between the stage and the auditorium, in case either takes fire: nevertheless we prefer the French way of forbidding such openings. In theatres which are properly isolated from the surrounding buildings, as is provided in the act, there is no difficulty in getting sufficient outlets from the stage and dressing-rooms; and for the audience, a direct exit in front of the proscenium wall is preferable to one through it. It seems to us, in fact, that exits at this point on both sides ought to be *de rigueur;* for in the first place, it is important not only that there should be many exits, but that they should be as wisely distributed as possible. And then it is to be remembered that though in a theatre the great point of danger is the stage, it is no more exempt than other buildings from the chances of fire in other parts of the house; especially when, as is likely to happen, shops or other premises in the front of the building are leased to outside persons. We think it also important that there should be stairs from top to bottom on each side the proscenium, against the stage wall; but these stairs are likely to be endangered and perhaps obstructed by putting doors in the wall beside them. An opening is desirable for the convenience of privileged spectators, who wish to pass from the auditorium, and especially from the stage boxes, to the stage; but for these openings in one story would be sufficient, if there were stairs at hand. The openings should be in the lower story, where they would bring the least danger; and it would be desirable to connect them with a corridor some ten or fifteen feet long, vaulted in brick, through which fire would not be likely to be communicated.

The question of the circulation and exit of the audience has been carefully considered in framing the act. An excellent provision is that on each floor or gallery, there shall be room outside the auditorium for all the spectators for whom places are furnished on that floor or gallery, allowing two hundred and fifty feet of area for every hundred persons. For three hundred persons in the theatre, there must be at least two exits; for five hundred, three; no door is to be less than five feet wide; and for every additional hundred persons beyond five hundred, an extra twenty inches of width is to be allowed in exit-room. Moreover, where there is more than one gallery, distinct places of exit are to be provided for each above the first, the spectators in the floor and first gallery being allowed the same exit.

At least two independent staircases are required for each gallery, and they must be on opposite sides; the same provision is required for the stage; and all these staircases must have their direct exterior outlets. Stairs which serve for the exit of fifty people must be at least four feet wide if they are straight, and if curved, five feet; and six inches in width must be added for every additional fifty persons. Stairs leading to the upper galleries are to be enclosed on both sides with brick walls; and all stairs and corridors are to be provided with hand-rails. Stairs that are more than eight feet wide must be divided by a rail down the middle. Wherever it is practicable, inclined planes, with a rise of not more than one in ten, are to be substituted for steps and stairs. In the auditorium, the aisles are ordered to have a width of twenty-two inches for every hundred persons who are to use them, and to be not less than three and a half feet wide in any case. They are to be increased in width toward the doors at

the rate of an inch in every five running feet, when possible; and the doors to which they lead must be as wide as the aisles themselves. No seat is to be farther than the sixth from an aisle; therefore there can be no more than thirteen seats abreast between any two aisles.

The special precautions that are ordered against fire are, a curtain of wire netting; one or more steam-pumps, of power enough to throw water to all parts of the building; stand-pipes with fire-plugs and hose at each floor-level, on both sides of the stage; a reservoir over the proscenium, to supply the stand-pipes; and sprinklers over the stage and auditorium. The theatres must be heated by steam, and stoves are banished and boilers isolated. It is also ordered that a sufficient number of uniformed firemen, under control of the city fire department, be in attendance on each performance.

There are many details by which the chief provisions of the act are guarded and supplemented, into which we have not room to enter. There are one or two restrictions which we should have liked to see added. We should have been glad to have second-story auditoriums absolutely forbidden. The use of premises beneath a theatre is altogether too dangerous to be allowed, we think, and the difficulty of getting an audience safely out too much increased by lifting them all an additional story. We have already argued for requiring stairs against the proscenium wall, in discussing the question of doors in that wall. On the other hand, the requirement of steam-pumps seems to us of doubtful utility. The head of steam which would be wanted to warm the building would not run the pumps even if the same boilers could be trusted to do it, nor could steam very well be got up in time to be any security to the audience, and on warm nights there is no steam. To compel a separate fire to be kept in readiness during performances would seem to be rather an unreasonable exaction. We do not know how much head the New York water-pipes supply, perhaps not a great deal with their present scanty provision; but every city ought to have a high service supply for just such emergencies, and it strikes us as more reasonable to look to this, or, if need be, to require it of the city, than to insist on the difficult and perhaps treacherous precaution of steam-pumps in the theatres, which only a very rigid inspection would keep in working order.

We are very glad to see this work taken in hand with the care and serious purpose that the act shows; and we hope to learn in due time that the act is passed substantially as it stands. It will naturally meet with some opposition, but we hope it will not be materially abated at any point, for all its chief requirements are the dictates of a larger experience than that of our own cities. Our present habit of theatre-construction is intolerably poor and mean; reckless is not too strong a word for it. Any third-rate Continental city would be ashamed of it. There is no reason why Americans should lag contentedly behind the rest of the world as they do in building; but they will do so unless they are hastened by legislation. Natural selection will not cure the trouble, or will do it too slowly for our safety. It must be provided for by careful and decisive enactments.

ARCHITECTURAL ILLUSTRATIONS.—II.

PROCESSES.

[From a paper read by Mr. Maurice B. Adams before the R. I. B. A.]

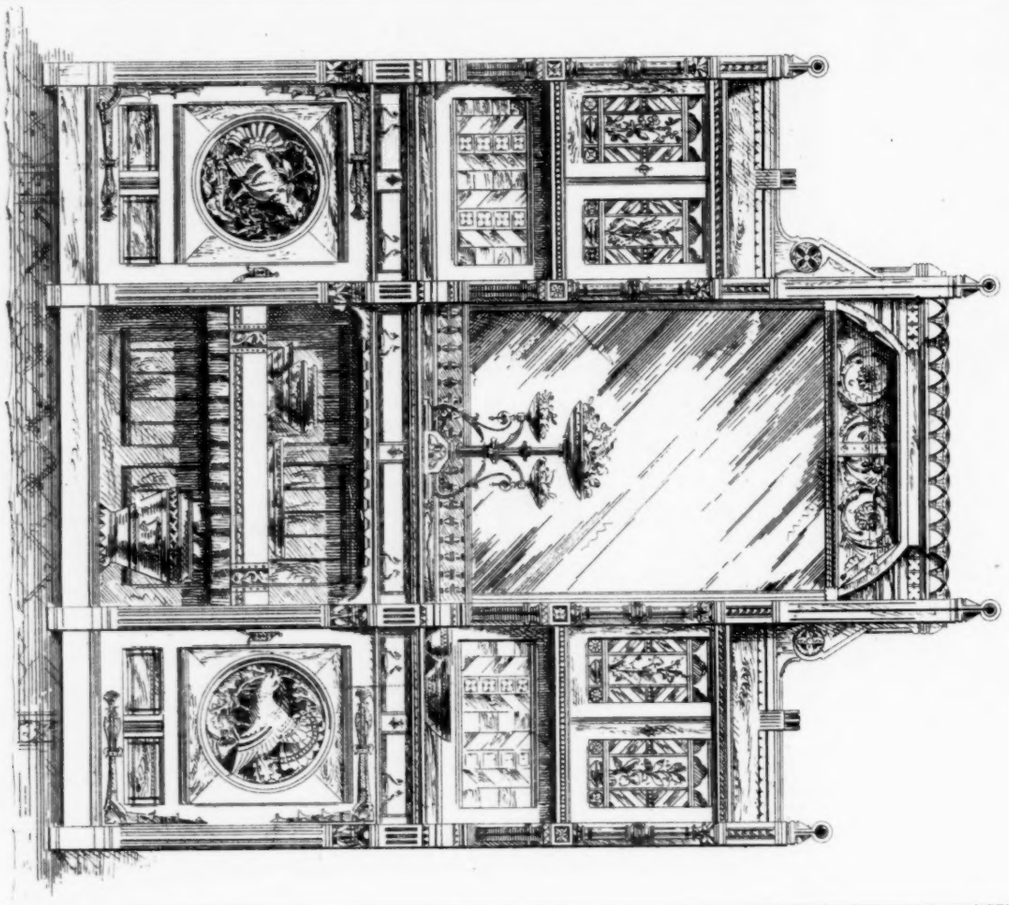
TURNING from a retrospective view, let us inquire what processes are now available for the production of architectural illustrations. Wood-engraving as the oldest at once presents itself. The ease with which wood-blocks can be "set up" and printed with type will always give the process a preference with publishers; while for the purposes of diagram it will ever command a large amount of attention. The chief drawback of its application to the higher forms of architectural illustration is the difficulty of securing an engraver whose technical knowledge is sufficient to enable him to preserve those qualities so indispensable in an architectural drawing; and I think you will readily agree that most woodcuts of buildings now published are characterized by this want of technical feeling. Those in the works of Viollet-le-Duc are an exception; indeed, where old work is represented they are every thing that could be desired; but the work of the engraver is reduced to a minimum, as the design is shown mainly in outline, while the drawings are made on the wood by M. Viollet-le-Duc himself. And this should always be done when possible, either by the architect or some technical artist employed by him. Blocks already prepared can easily be obtained; and drawing on the wood is by no means a difficult task. To proceed, you take a little Bath brick dust, and a small quantity of Chinese white; place them upon the block, and with the finger moistened in water, spread a light coat of the white over the block's upper surface, which when dry is ready to be drawn upon. This is accomplished by photographing or tracing a reversed outline of the subject upon the block, and then lining it in with a very hard pencil, according to the nature of the work; and in some cases a silver point is used. A piece of paper must cover the work when finished, and used for the hand to rest upon while drawing. The paper is fixed to the block by rubbing the sides of the latter with beeswax.

Turning to plate-engraving, whether on steel or copper, we find that it is now little used in this country for architectural purposes, although still very generally employed on the Continent. This being the case, a description of the process will be unnecessary.

Lithography was invented in 1798. All kinds of lithography are based upon the principle of the attraction and repulsion of various antagonistic substances, such as water and oil. The drawing is made upon the stone or zinc plate with either chalk, crayon, or suitable ink, all being materials of a fatty nature. When the drawing is completed, the stone is sponged with water, which takes to the stone where not covered by the lines of the drawing: these repel the water on account of their greasy substance. After removing the surplus water, the drawing is "rolled in" by passing a roller charged with lithographic ink, which adheres to the lines because of their mutual affinity with it, while the pores of the stone's surface in other parts, being saturated with water, resist the adhesion of the ink. The stone is now ready for printing, which is accomplished by placing a piece of paper on the stone, and pulling it through the press. The advantage of zinc plates is their portability. They are only adapted for ink-work. When chalk is used, it is very difficult to keep the shading open; and the graining of the plate's surface is likely to give streaks of high light through the shaded parts. Where the weight and bulk of the stone is not an objection, it should always be employed in preference to zinc. To draw upon either, trace a reversed outline of the subject with red transfer-paper on to the surface. With the red outline thus obtained as a basis, the work may be inked in; and for architectural work ink is certainly the best. To make a satisfactory drawing upon the stone requires practice and skill, more perhaps than, generally speaking, architects would be able to give. Lithographic transfer-paper is more usually used for the reasons I have given. Transfer-papers are prepared with a coating on one surface of either gelatine, starch, or gum, the object of this coating being to interpose a soluble film between the drawing and the paper, else the latter would absorb the ink instead of permitting all of it to be transferred to the stone. In using the transfer-paper, draw on the glazed side; and in no case touch its surface with the hand, using a finger-paper to work upon. The sketch or drawing to be lithographed can be traced, as transfer-paper is made transparent for the purpose; but when mathematical instruments have to be employed, a thicker paper must be used. The paper in any case should be stretched. Unstretched paper is liable to be acted upon by the breath, causing the ink to run, and the paper to bulge from the surface of the object being traced. If the paper work greasily, dust it with whiting or chalk powder; and mistakes may be erased with ink-eraser or rubber. Should the correction required be a large one, paste a piece of fresh transfer paper over the part, and redraw the portion as required. Do not use gum. Perry's pens are softer, and work easier than Gillott's. The ink is mixed by warming a small saucer, and rubbing a stick of ink so as to cover the bottom thinly with it; then, with a drop of *distilled* water, rub with the finger until the ink is dissolved. For brush-work the ink is used darker than that employed for the pen. The transfer is best made by a practical lithographer, who does the printing.

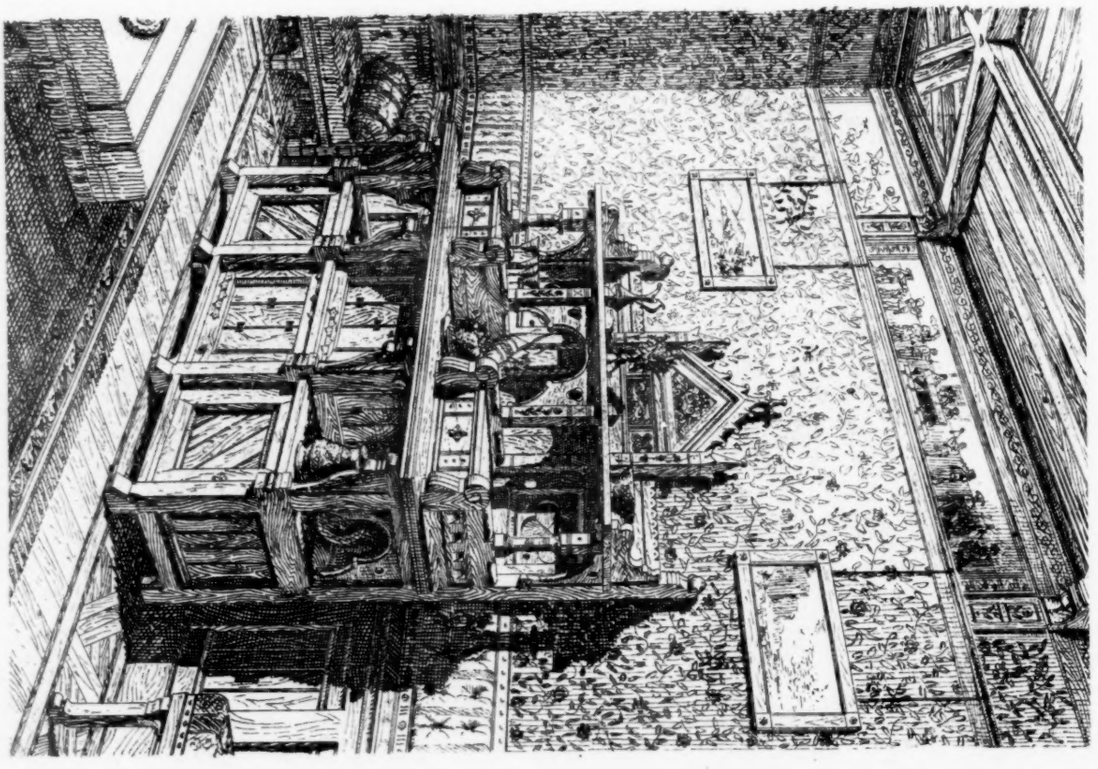
Chromo-lithography need be described only by saying that a separate stone is required for each color, and a corresponding series of printings are necessary. This of course makes its application very expensive. A process called "stenochromy" has recently been invented, by which a large number of colors may be introduced into an impression by one printing. Several attempts had previously been made, chiefly by employing blocks of color put together like a child's puzzle; but the results in these cases gave the outline between the colors resembling what is known as Tonbridge ware. In the last process the inventor, Mr. Radde, melts his colors together in frame so that they blend, the one with the other, in his prints.

We now come to those processes founded upon photography, by which permanent impressions may be taken either in color or printer's ink; taking photo-lithography first as the most important for our purpose. It is based upon the well-known action of light in rendering gelatine and similar bodies under certain conditions insoluble; and this principle is the basis of the autotype, heliotype, and Woodbury processes. The first photo-lithograph published appeared in the *Building News* in 1868. In most cases the subjects are reduced in size, but in other respects are exact facsimiles. In making a drawing for reproduction by this process, the most important point to be observed is that there are no tones or half-tones in a photo-lithograph: every thing about it is dead black and white. The effect must be obtained entirely by the intermixture of white and black, as in a wood-engraving. The work must be firmly and evenly drawn, in clear lines, with a uni-



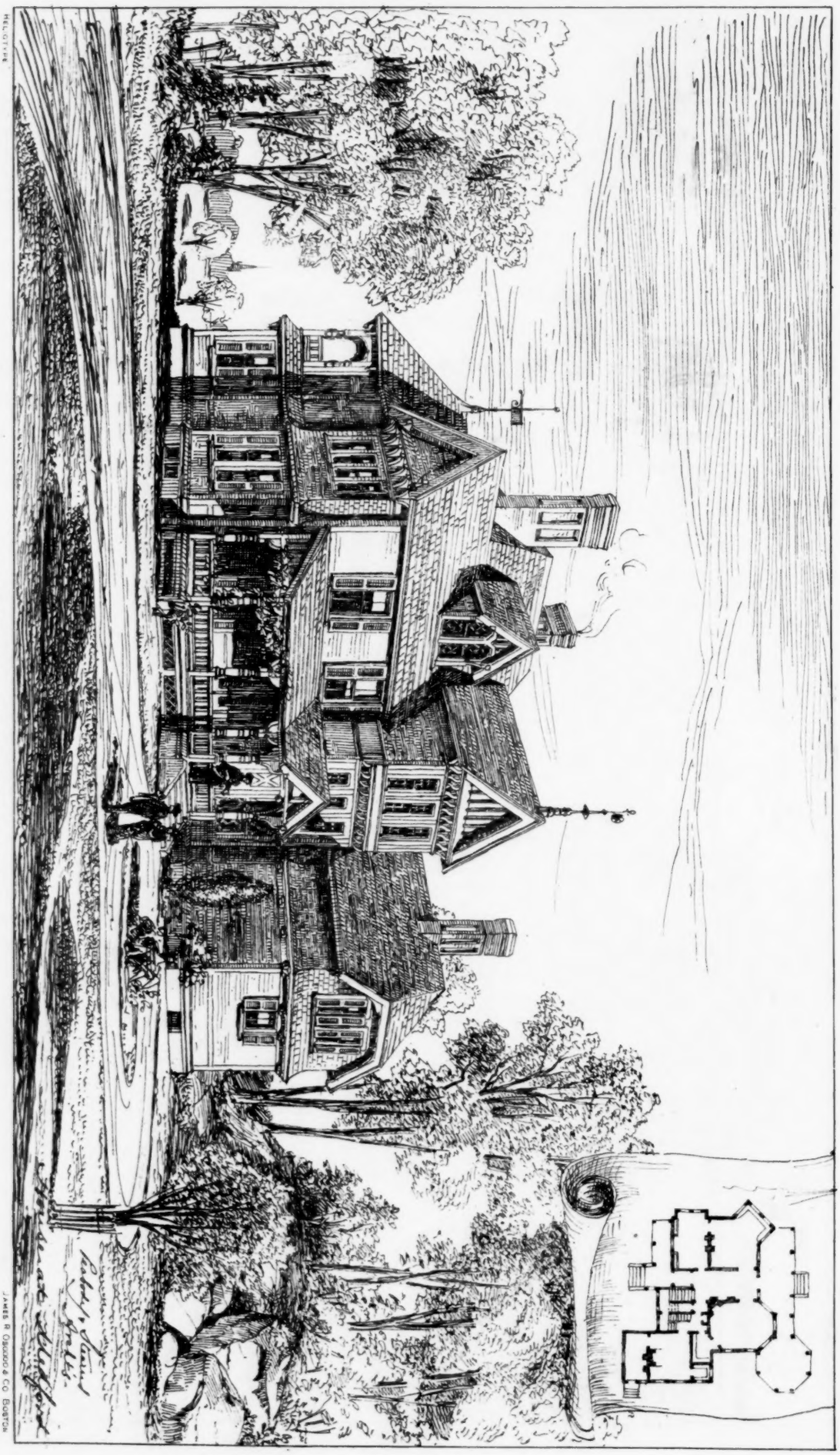
SIDE-BOARD.

MORLOCK & BAYER.



SIDE-BOARD.

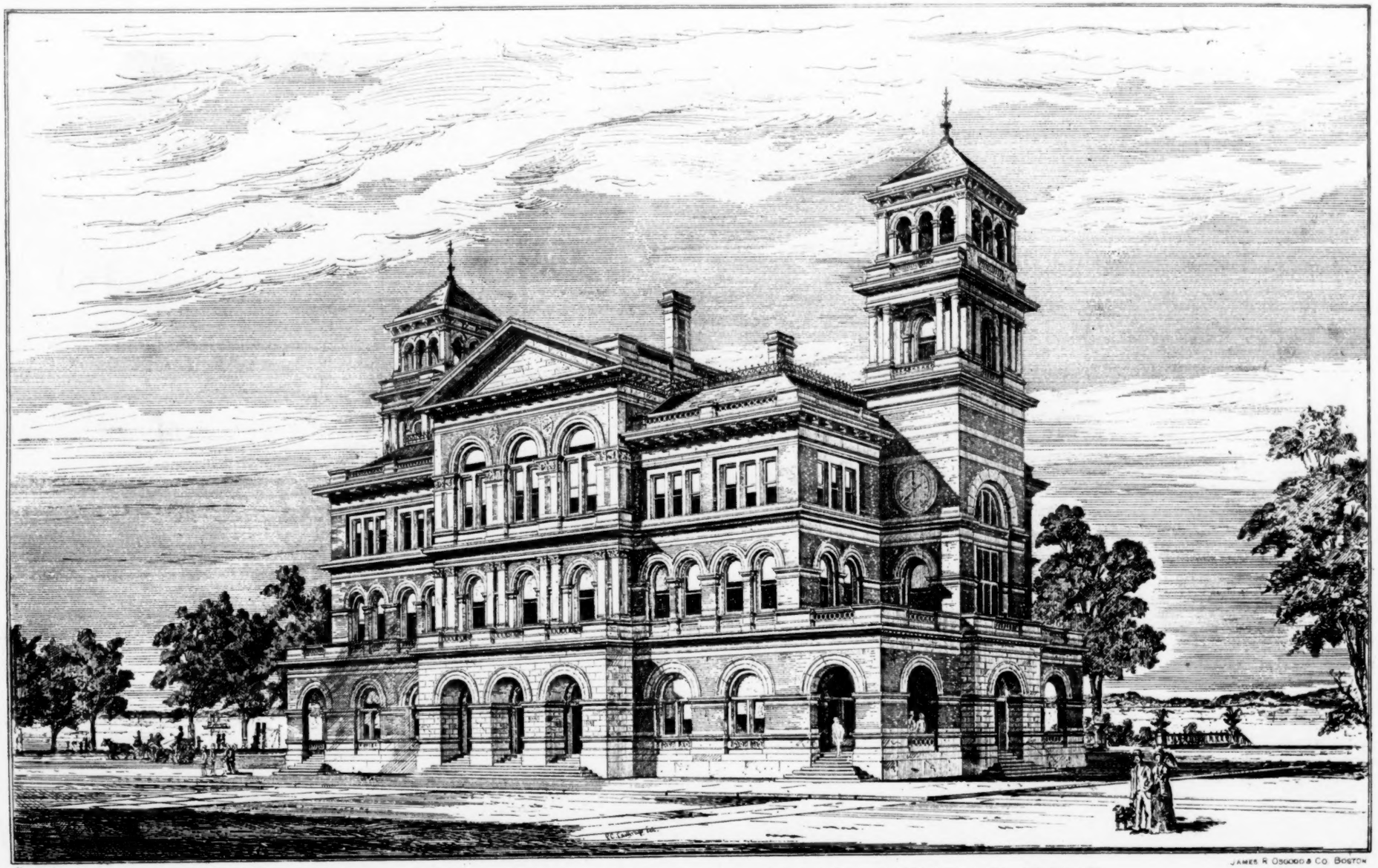
FERRY & GARDNER ARCHITECTS.



HOUSE AT MEDFORD MASS.

PEABODY & STEARNS ARCHITECTS.

American Architect and Building News. Feb. 17. 1877.

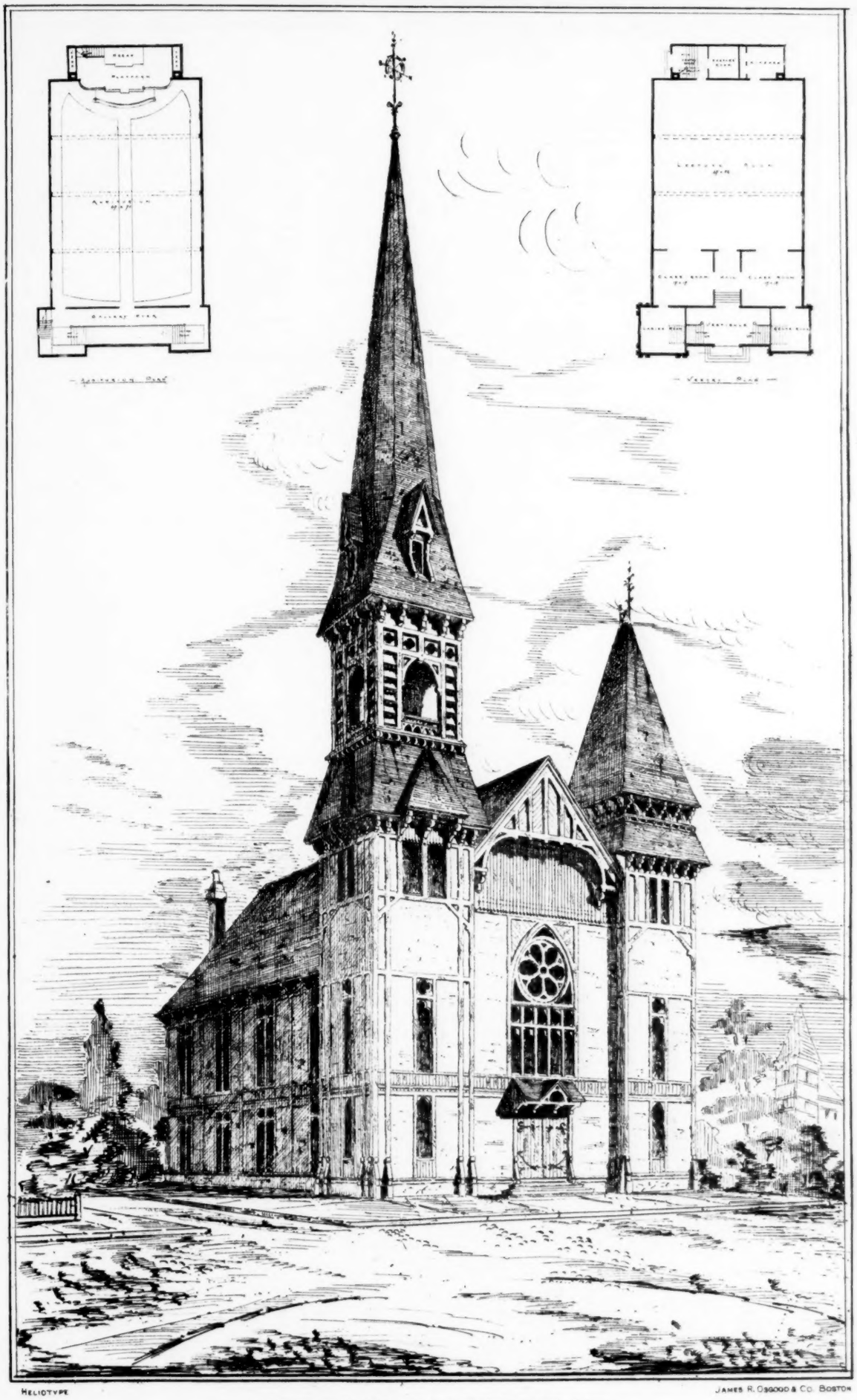


Heliotype

James R. Osgood & Co. Boston

U.S. COURT HOUSE AND POST OFFICE, MEMPHIS, TENN.

JAS. G HILL ARCHT.



HELIOTYPE

JAMES R. OSGOOD & CO. BOSTON

CHURCH AT FARMINGTON, ME.

STARBUCK & VINAL ARCHITECTS.

formly black or brown shade of ink throughout. The best ink is Indian ink mixed with a little lampblack, to give a deadness of line. The paper should be as white as possible, with a hot-pressed surface. For pen-and-ink drawings there is nothing like common registration ink on account of the bluish tone which it gives; and a satisfactory lithograph may be obtained from it if used freely and evenly, and of not too blue a shade. Brown ink reproduces very well when the work is executed in lines only, and not having the shadows washed in, as it were, with a lot of lines run together, as is generally the case in drawings of this nature. For then, instead of having a transparent shadow, similar to the original, the photo-lithograph will give a dead black or brown smudge, according to the ink used in printing. Pencil and chalk drawings do not permit of satisfactory reproduction by this process.

The object of the process is to obtain a transfer in lithographic ink, which transfer can be laid down upon an ordinary stone or zinc plate, and printed from in the usual way. The paper used is prepared with a solution of bichromate of potash and gelatine. The negative, opaque in the whites, and transparent in the blacks, is placed in a frame for printing, with a piece of sensitized paper close to it. The light passing through the transparent parts acts upon the paper, rendering some parts insoluble in warm water: therefore, when the prepared paper is placed therein, those parts not affected will wash away. Before it is washed, the paper photograph is lightly coated with greasy ink, after which it is floated in warm water face uppermost, the soluble parts being removed. It is then placed upon a sheet of glass, and, when washed and dried, is ready to be transferred to the stone.

The remaining processes are all more or less similar to each other. The heliotype is analogous to photo-lithography, but is more comprehensive, and admits of gradations of light and tone, so that photographs from water-color drawings or nature can be printed. The printing in this case is from hardened films of gelatine mixed with chrome alum, resembling horn. I have shown several specimens, and of the phototint, which is an improved form of heliography. The autotype is similar to the last, several inks being used for one impression, great skill being required in printing, which makes the process expensive. The Woodbury process up to a certain point agrees with those already referred to; beyond that it is totally unlike either. Instead of printing from the gelatine films, they are forced by hydraulic pressure into plates composed of lead and type-metal, from which the impressions are then printed in gelatine ink or color. The results obtained by the process are delicate and clear, resembling a photograph in every point excepting perhaps the fugitive nature of the silver print — the Woodbury type prints being as permanent as printer's ink can make them. The cost of the impressions is rather more than those from the other kindred processes; and, like photographs, they require mounting, which of course not only adds to their expense, but their bulk for binding purposes. I have only to add that Mr. Woodbury is said to be continuing his experiments, with the idea of printing photographs in permanent colors, by combining his own process with the "stenochromatic," to which I have already alluded.

For a few copies of working-drawings, the aniline process of photographic printing is both suitable and economical, and can be recommended. It is only suited for the reproduction of boldly drawn *black ink* tracings.

Photography itself, of course, is an exceedingly important medium for the illustrations of architecture, not only for its own immediate productions, which for truthfulness and beauty must ever remain unsurpassed, but as a corrective against error in sketching, keeping the draughtsman up to the mark. Photography will never supersede sketching; indeed, it is not always possible to take interiors and details. Magnesium wire is sometimes used for this purpose; for instance, Mr. Parker obtained photographs of the Roman Catacombs in this manner. We have now touched upon all the more important processes applicable to the subject before us. All have their advantages as well as their objections. In my opinion none are so suitable, all things considered, as photo-lithography.

THE ILLUSTRATIONS.

SIDEBOARD DESIGNED BY MESSRS. MORLOCK AND BAYER.

(102 Dorrance Street, Providence.)

THE lower central section is arranged for one shelf covered with a cloth, with fringe and border hanging over front edge. On the right-hand side cupboard-door is carved a bird, the German name of which is *Auerhahn* (*Tetrao Urogallus*); on the left, a *Berghahn* (*Tetrao Tetrix*), — both treated conventionally, and to be carved out of the solid wood in high relief. These birds are known, but seldom seen, throughout Germany, Switzerland, and as far north as Siberia. In the upper central section is an arched mirror. On each side are cupboards. The foliage on the doors is to be carved out of the solid wood in low relief.

SIDEBOARD. MESSRS. FERRY AND GARDNER, ARCHITECTS.

(22½ Barnes Block, Springfield, Mass.)

M. E. CHURCH, FARMINGTON, ME. MESSRS. STARBUCK AND VINAL, ARCHITECTS.

(No. 639 Washington Street, Boston, Mass.)

This church, which is now building, is meant to accommodate five hundred persons in the auditorium, and one hundred in the gallery. The finish is of ash in the principal rooms; and the pews, which are laid in circular form, are of the same material. The interior truss finish is of pine, and with the walls will be painted. The windows are to be filled with rolled cathedral glass.

HOUSE AT MEDFORD, MASS. MESSRS. PEABODY AND STEARNS, ARCHITECTS.

(60 Devonshire Street, Boston, Mass.)

UNITED STATES COURT-HOUSE AND POST-OFFICE, MEMPHIS, TENN. MR. JAS. G. HILL, SUPERVISING ARCHITECT OF THE TREASURY DEPARTMENT.

The cost of this building is limited by act of Congress to $400,000, of which amount $101,000 were appropriated in July, 1876.

AMERICAN INSTITUTE OF ARCHITECTS.

BOSTON CHAPTER.

THE regular monthly meeting of the Boston Society of Architects was held on the 2d inst., at the Institute of Technology, the President in the chair.

The Secretary read the minutes of the last meeting, also various communications received during the month from the Secretary of the American Institute; from the Boston Society of Civil Engineers, concerning the metric system; from Mr. S. J. F. Thayer, asking that a doubtful question in professional practice might be discussed by the Society; and from Mr. Frank Darling of Toronto, asking for copies of documents to aid in the formation of an architectural association at that place.

The Society then proceeded to examine the pieces of frieze sent in in response to its invitation, and to award the prize offered for the best design. Thirteen friezes had been received, and two more have been sent in since the meeting, which had to be treated as *hors de concours*. After a careful examination the prize of fifty dollars was awarded to Mr. John Evans of Boston. The design of Mr. Lyons was selected for honorable mention as next in order of merit. (The friezes have all, including those received after the meeting, been placed on exhibition in the Roman room of the Museum of Fine Arts.)

A number of samples of enamelled bricks were received from the manufacturers, the Brick Enamelling Company of Philadelphia.

The Secretary remarked that it had been brought to his notice, that in the copies of the Constitution and By-Laws of this Society recently printed and distributed, certain amendments adopted some years before and never printed with the By-Laws had been inadvertently omitted. He asked for authority to cause a printed slip to be inserted in the remaining copies, which was granted.

The subject announced for discussion was then taken up, namely the present revival in England of the style of architecture commonly known as the Queen Anne style.

Mr. Van Brunt opened the discussion by remarking that the Queen Anne style has been improperly named. Its peculiarities were developed chiefly under the Stuarts, and had run into extravagance and decline before the time of Anne. After the Gothic of the middle ages had perished, a succession of mixed styles came into vogue one after another. The architecture of the Tudors was essentially mediæval with a tinge of classic; but the classic feeling gradually gained ground until under the Stuarts the style was essentially classic, but pervaded with much of the freedom of the mediæval. Later still, under Queen Anne the classic had conquered the whole field, and became entirely formal. The state of things at present prevailing in England is remarkable: after having become to all intents and purposes the national and generally accepted style, the Gothic is now abandoned by a considerable number of the younger architects, who are doing their best to revive the style known as the Queen Anne style. We are living in what may be called an epoch. We know every style as well as the generations did in which they were first known and practised. But our general knowledge prevents us from having strong convictions. The Gothic revival of the present century had a literary origin in the works of Pugin and Ruskin. The present movement has no such cause. What then is its motive? Is it in a returning love of symmetry and order? A conspicuous instance of the adoption of the style in a continuous series of buildings is seen in the buildings lately built by Mr. Robeson for the London School Board. The recent competitions at Oxford also furnish a notable instance. The style certainly seems to have elements which make it peculiarly adapted to modern uses.

Mr. Cabot thought the question as to the desirability of this revival should be determined by the test of practicableness. Judged by this test he would be inclined to say that it could not be regarded as an advance over the Gothic till now so universally practised. The stepped gables, for instance, present in a climate like our own certain obvious objections; and most of the external

peculiarities of the Queen Anne style are open to the suspicion of a certain straining after picturesqueness, at the expense of good sense and good construction.

Mr. Van Brunt thought the stepped gable an allowable play of fancy, regarding it as simply the development of the sky-line of the gable, which in the more rigid Gothic is apt to be somewhat hard and uninteresting.

The secretary thought Mr. Van Brunt attached too much importance to the present movement in England. He thought it had not yet reached the dignity of a revival, and was only to be regarded as a fashion of the day, based on personal preference and personal taste, and having no root in reason or practical or artistic value. He would concede a certain picturesque charm to the old buildings of this style, but it was a charm largely due to age and decay, and was more especially felt in the country mansions where the architecture was helped out by the natural surroundings of trees and turf and gardens, etc. It is a style which requires of the architect of to-day the sacrifice of many modern notions which have come to be regarded as indispensable, such as large sheets of plate glass, double hung sash, narrow house-lots in cities, etc.

Mr. Van Brunt said the interior features of the style are extremely interesting, and quite adapted to modern uses, — the attenuated orders, the small projections, and general delicacy of design. The staircases are especially admirable.

Mr. Cabot agreed to this, and observed that many of the old mansions of New England had a good deal of this character in their interior finish. He has sometimes taken portions of such finish from old houses and set it up in new ones without substantial change. In using a style like this it is very necessary to exercise a careful discrimination, and to use only what is good in it, rejecting what is objectionable.

Mr. Clough said he had tried in recent school buildings for the city, to adapt the style to modern requirements, but had found the result to be not altogether satisfactory, and certainly not tending towards economy.

The Secretary condemned the puerility and feebleness of ornamentation which characterizes this style, — the wriggling gables, the little pyramids and balls and scrolls stuck about on every shelf and corner, — as unworthy of serious imitation; and contrasted all this nonsense with the grace and dignity and real picturesqueness of the style which prevailed at about the same time in France.

After some further discussion the meeting adjourned at about ten o'clock.

CORRESPONDENCE.

THE CONSTRUCTION OF MEMORIAL HALL. — THE PERMANENT EXHIBITION. — GRACE MEMORIAL CHURCH. — THE BELLS OF ST. MARK'S CHURCH.

PHILADELPHIA.

THE steamship "Pennsylvania," which sailed on the 1st inst. from this port for Liverpool, took out among her passengers Mr. Clement M. Biddle, the president of the Permanent Exhibition Company, and with him as consulting architect, Mr. Schwartzmann. They are to visit the permanent exhibitions of Europe, and, on their return, report upon the management and arrangements of them about the first of May. Mr. Schwartzmann was formerly landscape-gardener of the Fairmount Park, and later has become known as the architect of several buildings within the enclosure of the Centennial Exhibition, the principal of which is Memorial Hall, a building which almost from the very outset has been among educated people regarded as so far from being a success, that it is beginning to be very generally regretted that such a work should stand any chance of going down to posterity as representive of the architecture of the period. It was well known that the construction was very faulty; and the fact that the ornament, where not meagre, is meretricious, has been appreciated even more since the Exhibition than it was before. The large and highly decorated consoles in the rotunda, which appear to support the dome, are nothing less than hollow plaster affairs, which are hung indirectly to the iron dome by wires; while the construction of the dome itself seems to need all its strength to support the weight of the superfluous material which has been so needlessly used in the framing. As to the decorations of the exterior, the carvings over and around the entrance, the spread-eagles of stamped zinc painted and sanded to match the granite, with their wings supported with a tie-rod, — this is all beneath criticism; and it is hardly too much to say that Mr. Petit's frank, honest, and masterly construction, open and apparent to every one, in the Main Building and Machinery Hall, seem even with their transient character to be far more representative work than what is beginning to be regarded as rather an absurd sort of elephant on the hands of — well, probably the State as much as any one may be considered the owner. However, it is generally understood to be in the hands of a commission; and what is to be done with it remains to be seen. This winter it has been proven that it is extremely difficult to heat. The Pennsylvania Museum and School of Industrial Art seems to consider that it has the prior right and title to its occupancy; but how that occupancy is to be rendered in any way successful or useful, also remains to be seen. The time may come, sooner perhaps than we realize, when the city will be quite as thickly built up and inhabited all around the Fairmount Park as it is around Independence Square; and this location may then be found sufficiently central for the purposes of an art-educational headquarters; but near as that may be, — judging by the increase and extension of the city within the past half-century, — it is yet too far in the future to blind practical people to the awkwardness, to say the least of it, of the locality for such a purpose at present. The old Quaker prejudices of Philadelphia die hard. There is no lack of liberality towards public institutions and educational movements; but when it comes to any thing in the nature of local art, it is very often quietly smothered.

The average Philadelphian takes no pride in an art object being *par excellence* a local production. He is proud of the extent of the manufactures of the city, and of their mechanical excellence, but never for a moment seems to associate with them any ideal thought. For plain, substantial, commonplace things, home-manufactured articles satisfy us; but when we begin to look up any thing of an artistic or decorative nature, we must go to New York, Boston, or London or Paris. Indeed, it is saddening to notice how much of this feeling may be observed in our best shops, where goods of local make have to be misrepresented as otherwise in order to secure sale. This is one of the most serious matters which must be overcome before the new School of Industrial Art will be able to make headway in the community; and some very plain and embarrassing facts must be widely published ere the real value of such an institution begins to be realized in this city.

The managers of the International Exhibition, as the Permanent Exhibition Company seems to be known, are advancing bravely towards its opening, which it is expected will take place about the middle of May. It has issued an official bulletin, in pamphlet form, giving a sketch of the plan and objects of the enterprise, and much valuable information for exhibitors. A large open space in the centre of the building will be partitioned off, allowing accommodation for eight thousand people. Seats will be arranged in tiers from the floor to the organ-gallery (where the Roosevelt organ remains), for the accommodation of orchestras and choruses. South of this will be the art-gallery. The portion lately occupied by the South American republics, China, and Japan, will be allotted to the machinery. Some minor exhibits of a miscellaneous character are to go in the portion where Italy, the Scandinavian countries, and the English provinces exhibited; and the whole eastern portion, that during the Centennial was almost exclusively American, will be assigned to the industrial exhibit.

The past month of January shows the smallest number of building-permits ever issued for any one month, being only forty-five.

A handsome little church, with sittings for about two hundred and fifty, has just been completed at Darlington, Md., by Mr. Chandler; it will be known as Grace Memorial Church. The plan consists of a nave of five bays, chancel with small sacristy on south side, south porch, and, balancing it on the north, a semi-octagonal baptistery. The material of the walls is a delicate gray local soapstone, finished alike inside and out, affording a much more pleasing effect than the cold tint of marble, — in fact, a tender gray, more like that which time alone seems to have given to the old cathedrals of Northern Europe. The second bay on the south side is run up into a gable, to afford room for a very fine memorial window from the establishment of Charles Booth. The glass-work throughout is set immediately into the stone jambs of the windows, doing away entirely with the usual wooden frames.

Mr. Chandler has also just completed a very fine large residence at the south-west corner of Nineteenth and Spring Garden Streets, for Mr. W. S. Reyburn. The style is a species of Venetian classic, the material Connecticut brown stone. The door and windows have semicircular heads with pointed hoods, and the dormer-windows have stone canopies with boldly carved finials; the capitals of the imposts and the arch-heads display some excellent carving by Alex. Kemp. The Spring Garden street front has a central main entrance, on one side of which is a bay-window of two stories, running up to the cornice level; and on the Nineteenth-street side are two bay-windows, — one of two stories, besides taking in a portion of the basement, which, by reason of the ground falling off, gives very eligible rooms; and the other corbelled out at the second-floor level. The whole building has a solid and substantial appearance without looking in any way heavy in mass or clumsy in detail. In the rear is a handsome stable in two stories, of red pressed brick, with brown-stone wrought work; on the second floor of this is a commodious billiard-room. The decorations and hangings of the house interior are by Herter of New York.

On the 3d inst. came up in the court of common pleas the case known as "George L. Harrison, *et al.*, *vs.* the Rector, Church-wardens, and Vestrymen of St. Mark's Church." The centre of the court was occupied by a model at about an eighth of an inch to a foot, of the church and houses occupying the two blocks extending from Walnut to Spruce Streets and from Sixteenth to Seventeenth Streets. The case is being argued before judges only, it not being a jury trial. The grounds of complaint are that four bells have lately been hung in the tower of this church, and have given great and varied annoyance to the occupants of the houses in the neighborhood. The defence shows that the bells are much lighter than those of other chimes in the city and neighborhood:

that they are hung sixty-seven feet above the level of the curb-stone; they are also stated to be twenty feet higher than the bells of St. Stephen's in Tenth above Chestnut Street, and twenty-five feet higher than those of St. Patrick's, a church within about three squares of that in question, and that they are rung only at the usual hours for service. In the final decision of the court, which may be rendered shortly, it can hardly be doubted that the bell-founders will be quite as much interested as any class in the community.

THE "COMPETITION" TRACT.

THE Committee of the American Institute of Architects has again called attention to this subject, and invited critical correspondence. In so doing they seem to ignore the fact that there is a respectable minority of the profession, whose views have already been given them, who are opposed to competitions altogether, and who believe it the duty of the Institute to throw its influence strongly in this direction. If an evil cannot be abolished, then is the time to regulate it. It is painfully evident as time goes on, that the reform efforts of this so-considered representative society are timid and feeble.

The opponent of competitions in this country finds able backers among his English brethren, notably in a former president of the London Architectural Association, and in Mr. Charles Barry; the latter of whom, in his inaugural address, styles the "present system of architectural competition" as "hateful."

That competition leads to a great amount of hard feeling among architects, is plain enough. That it has precedent or parallel in similar callings, cannot be shown. Every attempt to regulate it has proved simply farcical. The efforts of its advocates have sapped the dignity of the profession and reduced rates of compensation; and their practices have been especially injurious to the very class it is loudly proclaimed are to benefit by the system, — the younger men. They are met at every turn by the statement that men who they know ought to know better, and can afford to do better, will do work for half price and furnish sketches gratis, on the chance of employment. This beggar's attitude — sketch in one hand and hat in the other — in which we are constantly presented, is the cause of half the bad treatment received, and is only made worse by complaints of want of appreciation by the public.

Most of the evils which seriously and permanently affect the standing of the profession are the fault of architects themselves; and the sooner the fact is recognized, the better. If the impression is persistently cultivated that "show drawing," or in fact any drawing as such, is the principal part of service, and that drawings may be had for the asking, is it strange that people will not value our work above our own price?

But the worst results come from the reaction on the profession itself. The present practice poisons the sources of education, and encourages the crowding of the lower ranks with half-taught youth who are led to hope that by some lucky bit of art gambling, backed by clever tricks of draughtsmanship, the highest professional position may be attained in a day. This effect is nicely described it the "Tract" as "Opening a Chance of discovering Unknown Talent." It may be that the substrata of American society are full of architectural genius, which it is the business of the Institute to drag to the surface; but the popular belief that real talent cannot be long hid stands the test of time better. The building of to-day would be sensibly improved if a greater interval of time, and consequent amount of professional drudgery, intervened between the teaching of the schools and the responsibilities which come with the charge of important works.

In the face of these and other reasons, why should the majority of the profession and the Institute be dragooned into practices against their highest interests? The necessity of the system is a myth and a bugaboo. It cannot be shown in tangible and reasonable form. It only needs a little vigorous treatment to consign it to its proper position among the blunders and follies of the past.

J. A. F.

THE DRAINAGE OF COUNTRY HOUSES.

TO THE EDITOR OF THE AMERICAN ARCHITECT AND BUILDING NEWS.

Dear Sir, — Mr. James C. Bayles, in a communication printed in your issue of Feb. 3, condemns the plan of underground irrigation as a means for disposing of household wastes. Having found this plan amply indorsed by the best sanitary authorities of England, and having used it, as I believe with complete success, for six years, I have ventured to recommend it as being by far the best system available in nearly all cases where there is no public sewerage.

Mr. Bayles's criticism has not had the effect of convincing me that I have been wrong in my judgment. He attaches more exclusive importance to the action of vegetation than I do, and he overlooks the oxidation of organic matter among the pores of an aërated soil, which is the great disinfecting action that the system secures. His modifications of the plan include the radical mistake of placing the pipes eighteen inches below the surface of the ground. I have adopted twelve inches as being the extreme admissible limit. Six inches would be much better, were it not that in our climate it gives too little protection against frost. The nearer to the surface, that is, the nearer to the air, — and incidentally the nearer to the roots of plants, — the better. Where frost is not to be feared, a depth of six inches should be adopted. Long and careful observation of the working of my own pipes has developed but one serious defect. The drains are under the lawn, which is conspicuous from the house and from the street; and it has been impossible to secure a fine covering over them, the soil along the lines being taken up by coarse, rank grass, which marks them distinctly.

I believe that even in Mr. Bayles's ground, although the atmospheric action at such a depth is very much less, no particle of organic matter is ever carried down to any considerable depth below his drains. The amount of liquid is small, and it is widely diffused. If delivered by a flush-tank in considerable volumes, it will saturate the ground near the pipes, and drive out whatever air its interstices may contain. As the liquid settles away, air will take its place; and furthermore, what does settle away will be in the condition of pure water, having left its impurities in the filter through which it has passed. Before his flush-tank delivers a second volume, these impurities will have gone far on their road to destruction.

At Merthyr Tydvil, in Wales, the whole sewage of a large town having an abundant water-supply is disposed of by what Mr. Bailey Denton calls "Intermittent Downward Filtration," through a light, loamy soil, underlaid by a very open, light, gravelly subsoil, which has its outlet through under-drains six feet deep. The area of this filter-bed gives about *twenty-two square feet* for each member of the population. The process has been entirely effective in purifying the sewage to the condition of "fair, potable water," although its original condition is so bad that the town had been prohibited by injunction from continuing to discharge it directly into the River Taff. The effluent water, as analyzed by Dr. Frankland, was found to contain in 100,000 parts only 0.688 of organic matter.

From a notice of the annual report of Dr. Dyke, medical officer of health of Merthyr Tydvil, in the *Sanitary Review* of Oct. 30, 1875, I quote: "As part of his duty he has 'from time to time examined the water flowing out, and satisfied himself that there has been no perceptible increase in the amount of organic matter dissolved therein.' For in July, 1872, it was proved by the investigation made by Dr. Frankland to contain only one part of organic matter in 200,000 parts of water; and in 1874 it was found just as free from impurity, showing that no saturation of the soil went on, the growth of vegetables on the surface, and the aëration effected by drainage, doing the work of purification effectually."

My suggestion is to use this system, usually where there is no public water-supply, with an area of 2,500 square feet for each household. If there are ten persons in the family there will be an area of 250 square feet for each. The character of the soil will have much to do with the *process* of purification, but probably not much with its *efficiency;* heavy clay soils exert in themselves a stronger absorptive action than do porous soils, but porous soils are much more open to the admission of air with its destructive oxygen.

Naturally, the system will work best when the ground is not frozen at all; and during the season of vegetation we have the further advantage, — which I believe to be only a secondary one, — that the products of decomposition are taken up by the roots of plants. If not so taken up, they would be entirely dissipated. Let us suppose that a household of ten persons uses 300 gallons of water per day. This will give three gallons of sewage to twenty-five square feet of ground. If there is no gravel streak to lead the descending water of heavy rains to the well, until we reach a depth of only six feet, we shall have 150 cubic feet of earth to filter three gallons of water per day. S. W. Johnson, in confirmation of his statements as to the absorptive power of soils, quotes as follows from Bronner:[1] "Fill a bottle which has a small hole in its bottom with fine river-sand or half-dry sifted garden earth. Pour gradually into the bottle thick and putrefied dung-liquor until its contents are saturated. The liquid that flows out at the lower opening appears almost odorless and colorless, and has entirely lost its original properties. . . . These examples sufficiently prove that the soil, even sand, possesses the property of attracting and fully absorbing the extractive matters, *so that the water which subsequently passes is not able to remove them; even the soluble salts are absorbed, and are only washed out to a small extent by new quantities of water.*"

All who have had occasion to study the action of earth upon manure well understand the fundamental agricultural principle that organic matter once seized upon by the soil is never again given up in its unchanged condition; and if any thing is certain in connection with the chemistry of the subject, it is that Mr. Bayles is mistaken when he says, "In a light porous soil, there is nothing to hinder the accumulations of six or seven months of each year from working down until the soil is saturated and our own or our neighbor's well polluted." There is unceasing oxidation to prevent any accumulation, and there is the unyielding grip of the interior surfaces of the soil to prevent added organic matters from working downward.

[1] How Crops Feed, p. 333.

It seems to me that Mr. Bayles has made the mistake of supposing that some such action is possible when sewage matters are discharged into the upper soil, as takes place when they leach away from an open cesspool through the fissures of rock in the case which he so well describes, or when they are discharged directly into a water-bearing stratum of the soil, or even when the discharge is always concentrated at the same point, as at the end of a kitchen drain. Probably no corresponding action would occur at a depth of several times eighteen inches below the surface, — though the deeper, the less the aëration and oxidation. That nothing comparable to it is possible with the system that I have recommended, seems very clear.

I have gone thus fully into the subject because it has interested me so intimately for years, and because my recommendation of sub-irrigation was not made unadvisedly. My faith is so strong that I am glad to have had this opportunity to give its justifying reason.

It is hardly worth while after my recent reply on the subject (Dec. 23, 1876) to Mr. Towne's communication, to do more than to reiterate the opinion there expressed of the tight cesspool, — that it is "sure to be, at best, only a mitigated nuisance, ready to become a source of real danger whenever its impervious wall is accidentally made pervious, or when its ventilation fails from any cause, or when its proper emptying is neglected, or when a sudden storm causes it to overflow or to set back into the house-drain."

I think that the tight cesspool is rarely to be recommended, occasionally to be permitted, and always to be suspected.

GEO. E. WARING, JUN.

TO THE EDITOR OF THE AMERICAN ARCHITECT AND BUILDING NEWS.

Dear Sir, — I have noted with much interest the letters from Col. Waring and Mr. James C. Bayles, which you have published in reply to my communication which appeared in your issue of 13th ult.

Permit me to recall the fact, however (which has, I think, been forgotten), that the question I proposed for consideration was, "How, *at reasonable cost*, can we secure the best result in disposing of sewage on level grounds?" and that I have in no sense undertaken to champion the use of leaching cesspools, but only to indicate how they could be used with the least danger in places where other systems, chiefly on account of cost, were excluded.

I may say further, that in addressing my first inquiry to you, I was impelled by a keen appreciation of the grave dangers involved in the use of the almost universal leaching cesspool, and by the hope that a discussion of the subject through your columns might lead to the publication of plans for dispensing with it, or at least lessening its power of harm.

Col. Waring, in your number of Jan. 27, reiterates his faith in the universal applicability of the Moule system of subsoil irrigation; but, in my opinion, still overlooks serious obstacles to its general use. In rebuttal of his views, Mr. Bayles, in your number of 3d inst., speaking from his personal experience, — his opinion, let me add, deriving additional weight from the good judgment and large experience of the giver, — makes objection that, in the climate of our Northern States, the system is practically inoperative during more than half the year, and is then open to the same objections as a leaching cesspool. Besides this objection others suggest themselves. Many of our houses have "basement kitchens," from which the soil-pipe necessarily passes at a point too low to admit of the Moule system on level ground; and, what in many cases I conceive to be the greatest objection of all, the area covered by the subsoil irrigation pipes is, on a small place, as likely as not to become the *children's play-ground;* unless, indeed, the already small limits of the latter be curtailed, and the appearance of the whole place injured, by railing off, as a sort of potter's field, the tract devoted to the reception of the household sewage.

Mr. Bayles in his letter urges the use of a tight cesspool, five feet in diameter and six feet deep, to be emptied whenever filled; but where there is an ample water-supply, such a cesspool would require attention every day or two. A cistern of the size named contains only some nine hundred gallons; and this amount of liquid will be discharged from a house containing (say) eight inhabitants, in about three days, under ordinary conditions. (The water consumption of London averages twenty-eight gallons *per diem* to each inhabitant; in Glasgow the same average is about fifty gallons.)

To dispose of this amount of liquid matter by carting it away would be very costly (it would weigh over three tons — one ton *per diem*); while to discharge by pumping this amount of sewage, greatly diluted though it be, upon the surface of even a large house-lot would, in my judgment, be very objectionable; to say nothing of the labor of pumping. In summer the plan would be least objectionable, if carefully managed, although of doubtful safety where the grounds are much used for pleasure, particularly by children; but in winter, when the purifying action of vegetation is *nil*, and all soakage cut off so that the tainted water either forms pools upon the surface, or, if frozen, does so ultimately when it melts, the system, it seems to me, becomes inadmissible.

Indeed, turn which way we may, the problem is beset with difficulties; and yet it is one of the utmost importance in every town not provided with a system of sewers. The wealthy householder can by liberal expenditure make his own arrangements safe, but he cannot protect himself from danger arising from the ignorance or indifference of his neighbors. The person of limited means, whether householder or tenant, may perhaps understand the importance of these matters (although how few, even of the best-educated classes, as yet realize their vital importance to every community!), but too often lacks the means to effect the necessary reforms or the knowledge as to what should be done. It was in the hope of eliciting information as to how, *at moderate expenditure*, comparative safety could be attained, particularly on level grounds, that this discussion was commenced. If it is abandoned at this point I fear we must regard it as a failure. I trust, however, that the discussion is not ended.

Mr. Bayles in his closing sentence touches on the most serious aspect of the present faulty systems, — the danger for the future; and we cannot too soon realize the importance of terminating the pollution of the earth around, and even under the very houses in which we live, which is now so extensively and so recklessly proceeding in every town not provided with a sewerage system.

In dealing with physical problems it is often useful to have them clearly stated and the issue well defined. The present case admits of such treatment, and may be stated thus: Of the sewage of an ordinary house, where there is an abundant water-supply, much less than five per cent consists of organic impurities and solid matter, all the rest being water. Now the question is, How can we separate these constituents, collecting the solids in a proper receptacle, and permitting the water, deprived of all impurities, to escape into the soil? Where cost is not considered this can undoubtedly be done by the use of settling tanks, filters, and constant attention. Can the same end be approximately obtained at moderate cost, and if so, how? Such a plan would avoid the objections I have pointed out in each of the systems advocated by Messrs. Waring and Bayles respectively. Is it attainable?

Yours respectfully, HENRY R. TOWNE.

STAMFORD, CONN., Feb. 9, 1877.

NOTES AND CLIPPINGS.

SCHOOLHOUSES FOR JAPAN. — The City Architect of Boston has completed plans of the Frothingham Grammar Schoolhouse, and the primary building at the corner of Roxbury and King Streets, to be sent to Japan. The Japanese Commission selected these as the model schoolhouses of all they saw in this country and Europe; and when in Boston purchased $10,000 worth of supplies, — books, school furniture, etc., — to be transported to their native country, and used to furnish buildings constructed after these models.

A CONCRETE WALL. — The United States Government has built a concrete wall at Minneapolis, Minn., for the protection of St. Anthony's Falls The wall, which cost $900,000, is 1,875 feet long, forty feet high, and seven feet wide at the base, diminishing to four feet at the top.

GAS-STOVES. — A warning against the ignorant use of the gas-stove is furnished by two deaths which have lately been caused by this seemingly safe and certainly convenient heating-apparatus. In each instance death was caused by the presence of carbonic oxide, — a gas which was produced by the imperfect combustion of the illuminating gas.

STATUES FOR THE HÔTEL DE VILLE, PARIS. — Twenty-two of the statues of the old Hôtel de Ville, in Paris, have been restored, and will be placed on the new edifice. They include those of Buffon, De Sully, Mansard, Debrun, Voltaire, and Vincent de Paul. Fourteen which were too much injured for restoration will be replaced by new.

THEATRE EMPLOYEES. — Of the 603 employees on duty at the Opera House in Paris during a ball or *bal masque*, 45 are managers and attendants, 72 are machinists, 18 are lamplighters, 42 are firemen, 4 are officers, 40 men are on guard inside the building, and 60 on the outside, making a corps of 281 men whose chief duty is to assure the safety of the visitors.

LA COLONNE VENDÔME. — The cost of rebuilding and repairing the column of the Place Vendôme in Paris, which was thrown down by the communists during the commune, is reported to be $64,718. The painter Courbet, who was instrumental in causing the overthrow, is made responsible for the money as far as his property, which is considerable, will allow.

UNDERGROUND RAILWAYS. — Not long ago the municipality of Paris sent a deputation to London to examine the underground railway. It has now been decided to build similar railways under Paris at a cost of 160,000,000 francs. The Seine will be crossed by two tunnels, one for the up line, one for the down, each enclosed in brick-work, surrounded by tubes of plate iron measuring over 18 feet in diameter.

ST. GERMAIN L'AUXERROIS. — The south side of St. Germain L'Auxerrois, Paris, which was built in the twelfth century, is to be restored at a cost of some $30,000. From this church was taken the body of the murdered Maréchal d'Ancre, which was dragged to the Place de Gréve, where its heart was cooked and eaten by one of the mob.

THE MOODY TABERNACLE AT BOSTON. — The Inspector of Buildings emphatically denies the report that the Tabernacle is unsafe.